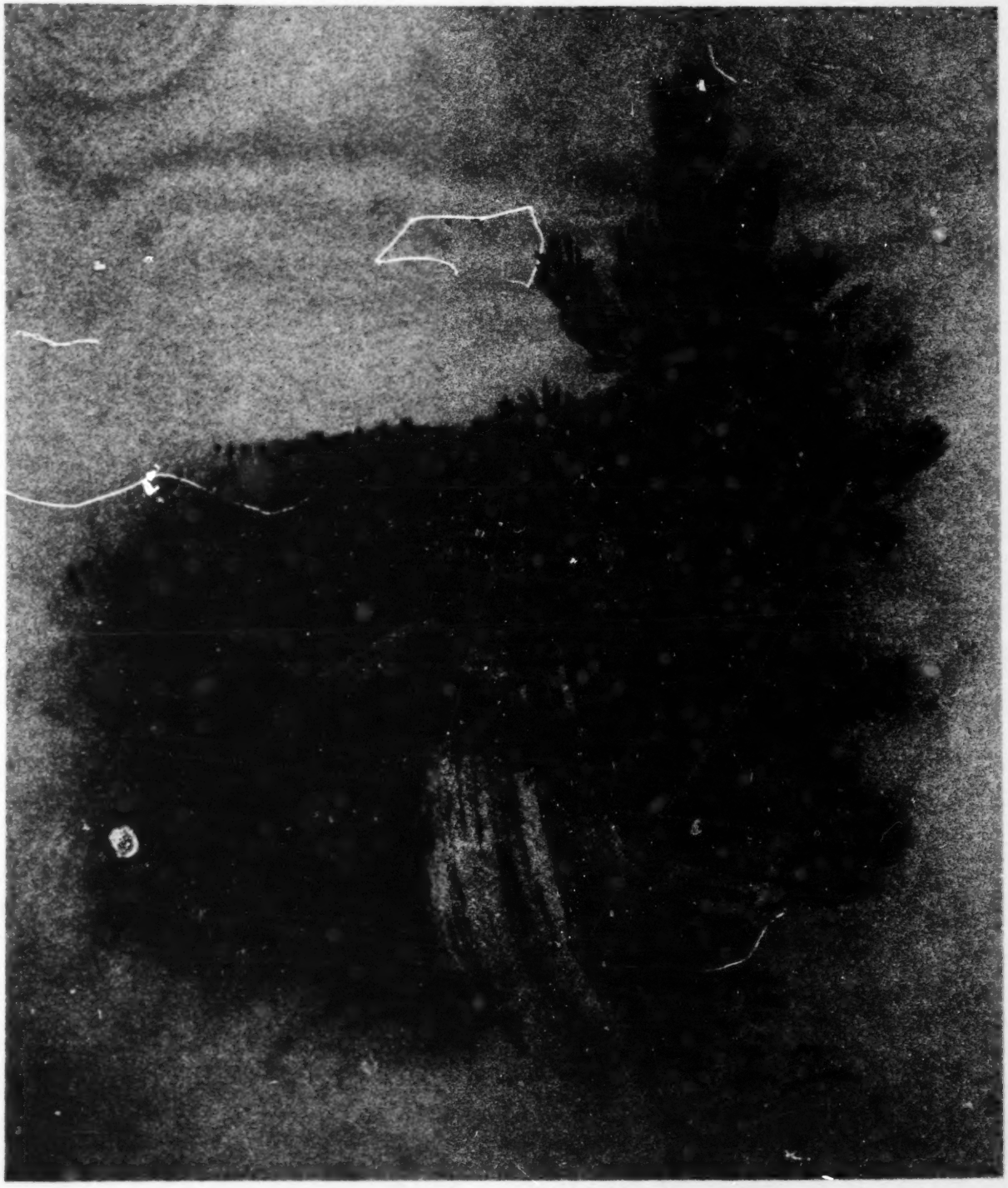
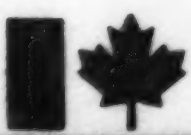
April 1984
ISSN 0226-9104

FIRST YEAR SURVIVAL AND DENSITIES OF 1980 PLANTATIONS





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This report has been prepared by

DEPARTMENT OF NATURAL RESOURCES
FREDERICTON, NEW BRUNSWICK

Minister: Hon. G. S. Merrithew

FIRST YEAR SURVIVAL AND DENSITIES OF 1980 PLANTATIONS

"This is a Federal-Provincial Development Project, funded under the Forestry Subsidiary Agreement of the Canada - New Brunswick General Development Agreement by the Government of New Brunswick and the Department of Regional Economic Expansion."

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Catalogue No: ISSN 0226-9104
Cover: Tim Fevens

ABSTRACT

Four thousand nine hundred and forty-six plots were established in NBDNR 1980 plantations. Overall survival one year after planting was 88% for bare root stock and 91% for paper pot stock.

The average planting density was 2,170 trees per hectare and the average density after one year was 1,960 trees per hectare. A significant portion of the area reported as plantation was in fact unplanted in each region except Region II. Also a significant portion of the planted area had planting densities in excess of 3,000 trees per hectare.

The average first year height growth for bare root stock was between 0.5 cm and 6.1 cm depending on species and for paper pot stock was between 9.1 cm and 20 cm depending on species. Bare root stock was taller than container stock when planted but container stock grew faster making up much of the difference by the end of the first year.

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INTRODUCTION

The province of New Brunswick has had an active tree planting program on Crown land since the early sixties. In 1974, with the aid of federal funding through a DREE grant the program began to expand rapidly, reaching 26.6 million seedlings in 1980. With the expanding planting program came the need for a monitoring system which would serve as a feedback for all other aspects of the reforestation program and would assist in predicting plantation development.

Originally each forest region was responsible for monitoring its own plantations but in 1977 the Forest Management Branch assumed responsibility for monitoring all plantations on Crown land. Monitoring during the establishment stage (0 - 3 years) is concerned primarily with survival rates, initial height growth and planting densities. Plots are established shortly after planting and are remeasured after the first and third years. Starting at age five, growth and development are monitored at five year intervals.

The results of the assessment of 1977, 1978 and 1979 plantations have been reported previously. This report contains information on planting densities, height and first year survival of 1980 plantations.

METHODS

Planting areas were mapped and stratified into "assessment blocks" by planting supervisors. Assessment crews ran lines in the blocks so as to give a representative sampling of the area.

Plots 5 metres in raduis were established at 50 metre intervals along the lines. Within the plots each planted tree was staked and numbered and height measurements were taken on the first five trees. The plots were re-examined in 1981. Density and height at planting, and survival, density and height after one year were calculated.

Four thousand nine hundred and forty-six plots were established in 10,900 hectares of 1980 plantations. Of these, 4,865 plots were established in 1980 and 81 plots were established in 1981 in areas missed in 1980. The 1981 plots cannot be used to estimate survival but can be used to estimate density and height after one year.

RESULTS AND DISCUSSION

Appendix I lists the survival, density and heights for all plantations and assessment blocks by region. This information and all pertinent maps of plot locations have been sent to Regional Resource Managers for their use (fill planting decisions, etc.).

SURVIVAL

Overall survival one year after planting was 91 percent for paper pots and 88 percent for bare root stock. Survival rates for paper pots were consistent between regions (Table 1) and between species (Table 2). Six percent of the area planted with paper pots had survival rates less than 60% (Table 3). The spots with low survival were scattered throughout many plantations rather than any one plantation having low survival. The mortality in most cases was related to severe micro site problems (e.g. flooding).

Survival rates for bare root stock were consistent between regions. The apparent differences betwen regions in Table 1 are actually differences between species. Region 5 has the lowest average survival but Region 5 planted only spruce and survival of spruce in Region 5 is similar to survival of spruce in other regions (Table 2). Bare root spruce had lower survival rates than bare root pine (83% vs. 91%). Eleven percent of the area planted with bare root spruce and three percent of the area planted with

bare root pine had survival rates in the failure range (Table 3). Survival rates between plantations were consistent (Appendix I) with the exception of P-11-80 which may have been affected by effluent from a mine. Nursery practices have been changed in an effort to improve the quality of bare root leaving the nursery. The changes include lower densities in the seed beds and heavier culling.

DENSITY

In 1980 plantations the average planting density was 2,170 trees per hectare and the average density one year after planting was 1,960 trees per hectare. The NBDNR guide to licensees is to plant 2,500 trees per hectare with a minimum acceptable standard of 2,000 planted trees per hectare in the year of establishment.

However averages do not give the entire picture. Figures I - V show the distribution of plots in each density class at the time of planting. Excluding Region 2, between 7.5% and 12.4% of the plots did not have any trees. This represents areas that were included in the plantation but were not planted either because they were missed by the planters or because they were unplantable. Care during harvesting and site preparation will ensure that the maximum area is plantable and adequate supervision of the planters will keep the missed areas to a minimum. However there will still be areas that are not planted. Accurate mapping is important to give a realistic indication of the area planted.

The "Forest Management Manual for Crown Lands" specified that plantations are to have at least 1,500 but not more than

3,000 trees per hectare at year 5 (including acceptable natural regeneration). If we consider 3,000 trees per hectare as the maximum number that should be planted then between 9.9% and 28.1% of the plots in 1980 plantations showed overdense planting (Figures 1 - V). This represents not only a waste of the planting resources but also may increase the plantation tending costs. Good supervision with careful planting procedures should keep the overdense planting to a minimum.

HEIGHTS

Table 5 shows the average heights of 1980 trees at the time of planting and after one year. In general, bare root stock was taller when planted but container stock grew faster making up much of the difference by the end of the first year. Red Pine bare root had the least height growth (0.5 cm) followed by black spruce bare root (0.8 cm), white spruce bare root (1.5 cm) and jack pine bare root (6.1 cm). In paper pot stock the least height growth was 9.1 cm by white spruce and jack pine. Black spruce paper pots grew an average of 10 cm while larch paper pots grew 20 cm, more than doubling in height. Black spruce styroblock grew 13 cm.

The much more rapid initial growth by container stock is interesting. If the growth rate continues it would give container stock an advantage on sites with a lot of herbaceous or shrub competition. This is important considering the problems associated with plantation tending and the control of competing vegetation.

CONCLUSION

Survival of paper pots continues to be good. There have been problems with bare root but measures have been taken to rectify the problems. There has been a problem achieving the desired density throughout the plantation but the problem is being worked on. Container stock is showing much more rapid initial growth than bare root stock.

Table 1. First year survival by stock type and regions for 1977, 1978, 1979 and 1980 plantations.

Region	Stock Type											
	Bare Root				Paper Pot				Styro Block			
	1977	1978	1979	1980	1977	1978	1979	1980	1977	1978	1979	1980
1	67%	64%	75%	84%	89%	88%	91%	92%	-	99%	-	-
2	65%	81%	90%	85%	87%	86%	88%	96%	-	-	-	-
3	77%	80%	79%	89%	89%	88%	92%	89%	-	-	-	84%
4	91%	85%	84%	87%	94%	90%	88%	90%	-	90%	66%	85%
5	78%	43%	76%	78%	94%	96%	92%	89%	-	-	-	-
Combined	73%	69%	81%	88%	90%	90%	91%	91%	-	95%	66%	84%

Table 2. Survival in percent one year after planting by species and stock type for 1980 plantations

Region	Black Spruce			White Spruce		Jack Pine		Red Pine	Larch
	BR[1]	PP[2]	SB[3]	BR	PP	BR	PP	BR	PP
1	76	92	-	82	91	90	92	97	92
2	88	96	-	78	97	93	93	89	-
3	79	88	84	88	96	93	91	96	-
4	90	89	85	78	89	94	98	89	-
5	81	89	-	77	90	-	-	-	-
Prov.	81	90	84	82	92	92	92	90	92

[1]Bare root stock
[2]Paper pot stock
[3]Styro-block stock

Table 3. 1980 Plantation areas[A] by stock type, species, region and survival class

Stock Type	Species	Region	Survival Classes: 100 - 91%		90 - 81%		80 - 61%		60 - 41%		< 40%		Total
Paper Pot	Larch	I	74[B]	(61)[C]	33	(27)	14	(12)	0	(0)	0	(0)	122
	Black Spruce	I	751	(69)	182	(17)	113	(10)	30	(3)	12	(1)	1088
		II	514	(88)	41	(7)	17	(3)	11	(2)	0		584
		III	552	(59)	145	(16)	152	(16)	62	(7)	21	(2)	932
		IV	393	(52)	175	(23)	133	(18)	39	(5)	15	(2)	755
		V	376	(52)	178	(25)	93	(13)	52	(7)	21	(3)	721
		Total	2586	(63)	721	(18)	509	(12)	195	(5)	68	(2)	4080
	White Spruce	I	138	(63)	50	(23)	25	(11)	6	(3)	0		218
		II	94	(85)	10	(9)	5	(4)	2	(2)	0		111
		III	15	(85)	0		3	(15)	0		0		18
		IV	49	(48)	27	(27)	25	(24)	2	(2)	0		102
		V	154	(58)	65	(24)	33	(12)	14	(5)	0		266
		Total	451	(63)	151	(21)	89	(12)	24	(3)	0		716
	Jack Pine	I	498	(71)	85	(12)	51	(7)	33	(5)	37	(5)	704
		II	437	(77)	94	(16)	29	(5)	11	(2)	0		571
		III	273	(61)	95	(21)	59	(13)	16	(4)	8	(2)	451
		IV	78	(99)	1	(1)	0		0		0		79
		V	0		0		0		0		0		0
		Total	1286	(71)	275	(15)	139	(8)	60	(3)	45	(2)	1805
Total Paper Pot			4398	(65)	1180	(18)	751	(11)	280	(4)	113	(2)	6722
Styro-Block	Black Spruce	I	0		0		0		0		0		0
		II	0		0		0		0		0		0
		III	45	(44)	26	(25)	15	(15)	16	(15)	0		103
		IV	27	(55)	11	(23)	7	(14)	4	(9)	0		49
		V	0		0		0		0		0		0
		Total	72	(48)	37	(25)	22	(14)	20	(13)	0		152

Table 3 (cont'd)

Stock Type	Species	Region	Survival Classes 100 - 91%		90 - 81%		80 - 61%		60 - 41%		< 40%		Total
Bare Root	Black Spruce	I	113	(28)	80	(20)	122	(30)	61	(15)	24	(6)	400
		II	52	(60)	18	(21)	12	(14)	4	(5)	0		86
		III	43	(26)	42	(25)	58	(36)	10	(6)	10	(6)	163
		IV	65	(56)	33	(29)	18	(15)	0		0		116
		V	13	(24)	16	(31)	15	(28)	8	(15)	2	(3)	53
		Total	285	(35)	189	(23)	224	(27)	83	(10)	36	(4)	818
	White Spruce	I	91	(39)	64	(27)	59	(25)	10	(4)	10	(4)	234
		II	4	(14)	10	(33)	12	(43)	3	(10)	0		29
		III	208	(56)	93	(25)	62	(17)	11	(3)	0		373
		IV	11	(12)	27	(29)	47	(50)	5	(5)	3	(3)	93
		V	35	(23)	48	(32)	50	(33)	11	(7)	9	(6)	153
		Total	348	(39)	242	(27)	231	(26)	39	(4)	22	(3)	882
	Red Pine	I	8	(100)	0		0		0		0		8
		II	39	(58)	14	(21)	12	(17)	3	(5)	0		68
		III	37	(84)	5	(12)	2	(4)	0		0		44
		IV	118	(57)	44	(21)	36	(18)	6	(3)	2	(1)	206
		V	0		0		0		0		0		0
		Total	201	(62)	63	(19)	50	(15)	9	(3)	2	(1)	325
	Jack Pine	I	298	(60)	97	(20)	80	(16)	20	(4)	2	(<1)	497
		II	217	(76)	51	(18)	17	(6)	0		0		285
		III	312	(74)	72	(17)	30	(7)	6	(2)	1	(<1)	423
		IV	12	(73)	4	(27)	0		0		0		16
		V	0		0		0		0		0		0
		Total	839	(69)	225	(18)	127	(10)	26	(2)	4	(<1)	1221
Total Bare Root			1674	(52)	720	(22)	631	(19)	157	(5)	64	(2)	3246

A Includes only plantations in which assessment blocks were established in 1980.
B hectares
C % of Region total

Table 4. Planting densities by Regions

Region	Density (trees/ha) 1977	1978	1979	1980
I	1,638	1,715	1,443	1,915
II	1,748	1,889	2,472	2,518
III	1,708	1,975	1,510	2,309
IV	1,659	1,977	1,677	1,904
V	1,704	2,626	1,617	2,218
Regions combined	1,685	1,948	1,649	2,170

Table 5. Height at the time of planting and after one year, by species and stock type for 1980 plantations

Region		Black Spruce			White Spruce		Jack Pine		Red Pine	Larch
		BR[1]	PP[2]	SB[3]	BR	PP	BR	PP	BR	PP
1	ORIG*	27	14		25	16	19	17	26	15
	1st Yr+	27	20		26	22	24	24	28	35
2	ORIG	23	12		24	11	18	8	25	
	1st Yr	26	20		27	20	25	16	27	
3	ORIG	24	10	13	21	11	19	11	24	
	1st Yr	23	19	21	23	14	24	23	26	
4	ORIG	24	12	13	23	11	25	15	22	
	1st Yr	25	25	34	24	26	26	32	22	
5	ORIG	22	11		18	12				
	1st Yr	23	22		19	22				
Prov.	ORIG	24.7	11.5	13.0	21.9	13.0	18.5	13.4	22.6	15
	1st Yr	25.3	21.5	26.0	23.4	22.1	24.6	22.5	23.1	35

*height in cm at the time of planting
+height in cm one year after planting
[1]Bare Root [2]Paper Pots [3]Styro Block

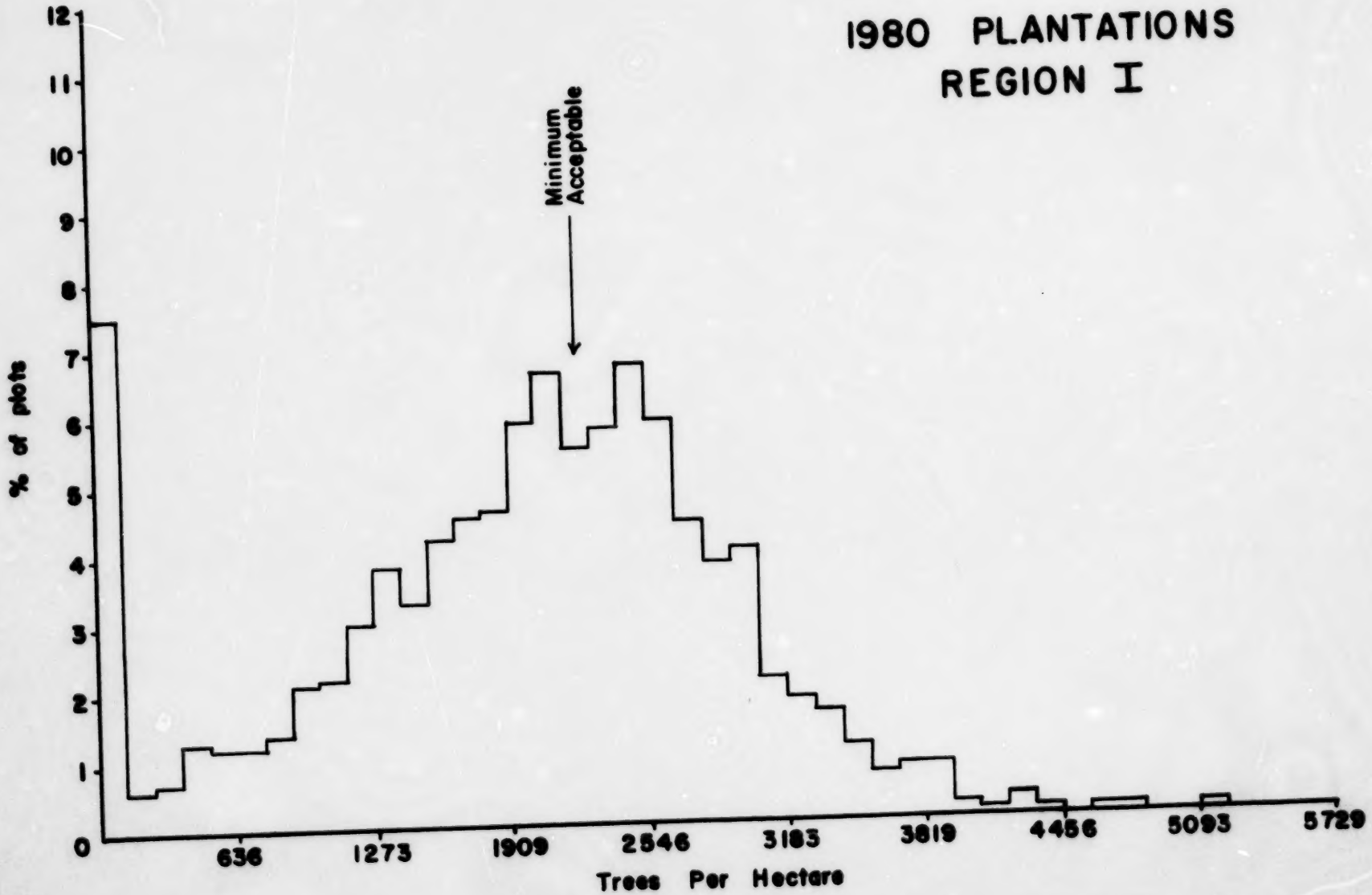


FIGURE I - Percent of plots versus number of planted trees per hectare at time of establishment - Region I

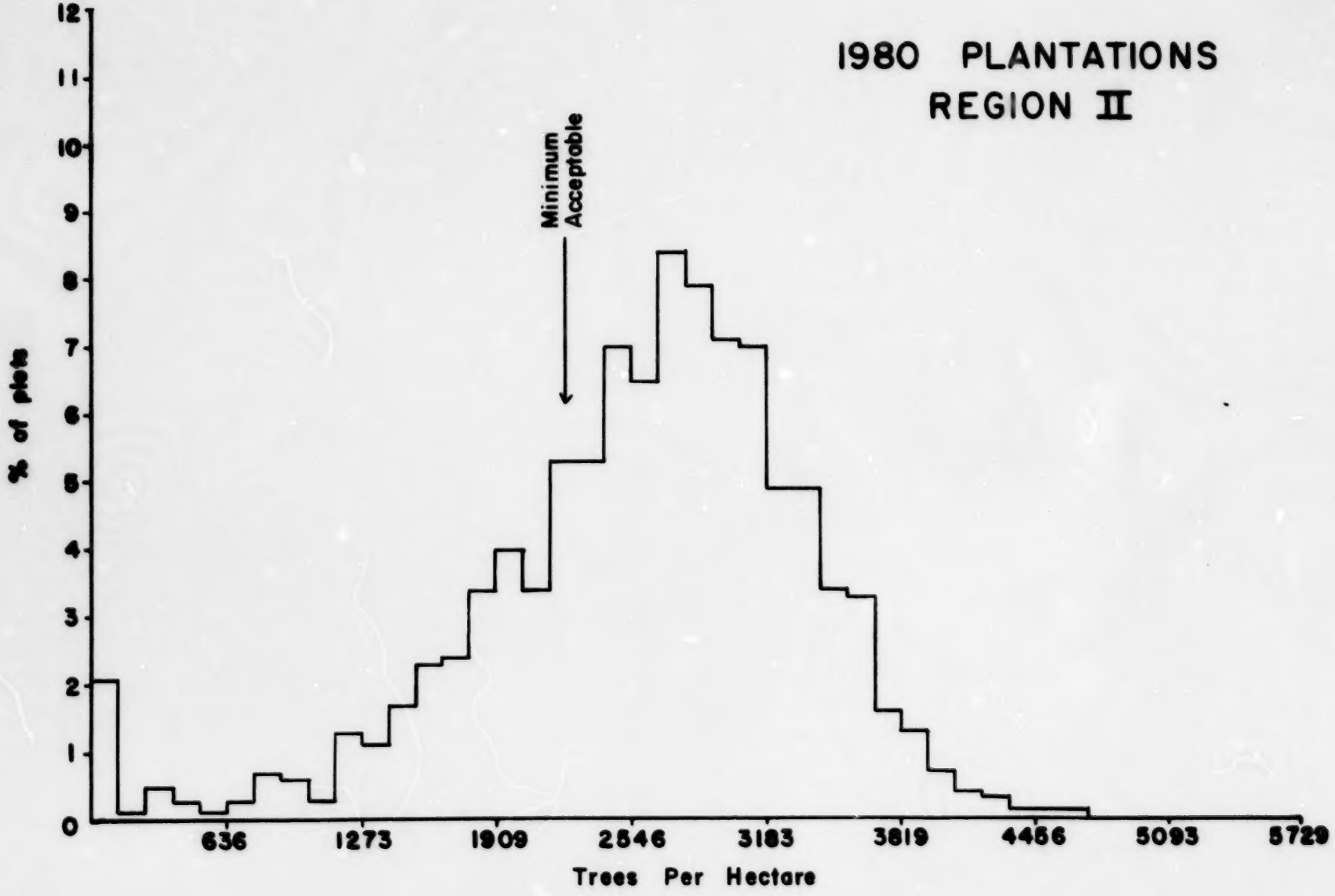


FIGURE II- Percent of plots versus number of planted trees per hectare at time of establishment - Region II

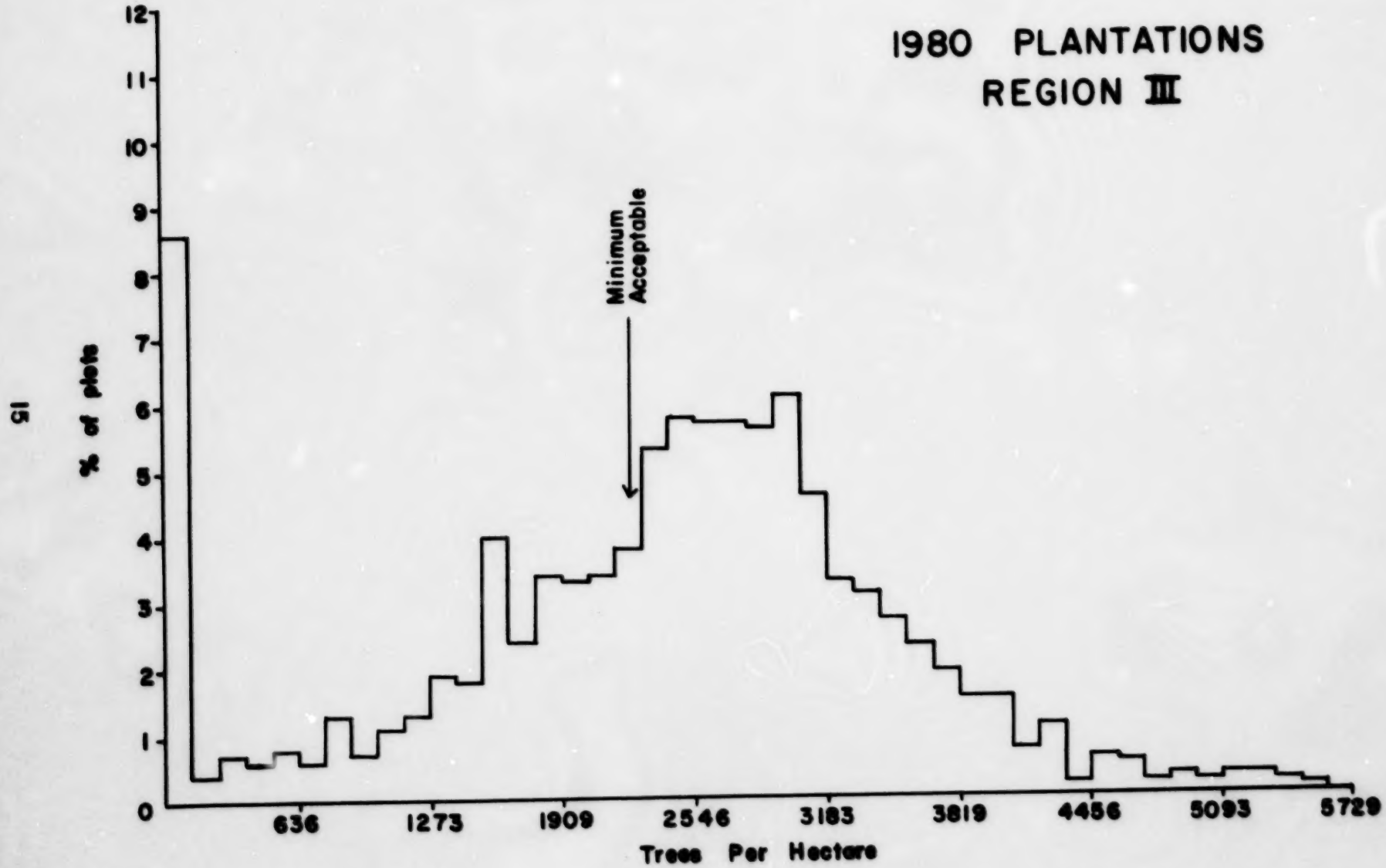


FIGURE III- Percent of plots versus number of planted trees per hectare at time of establishment - Region III

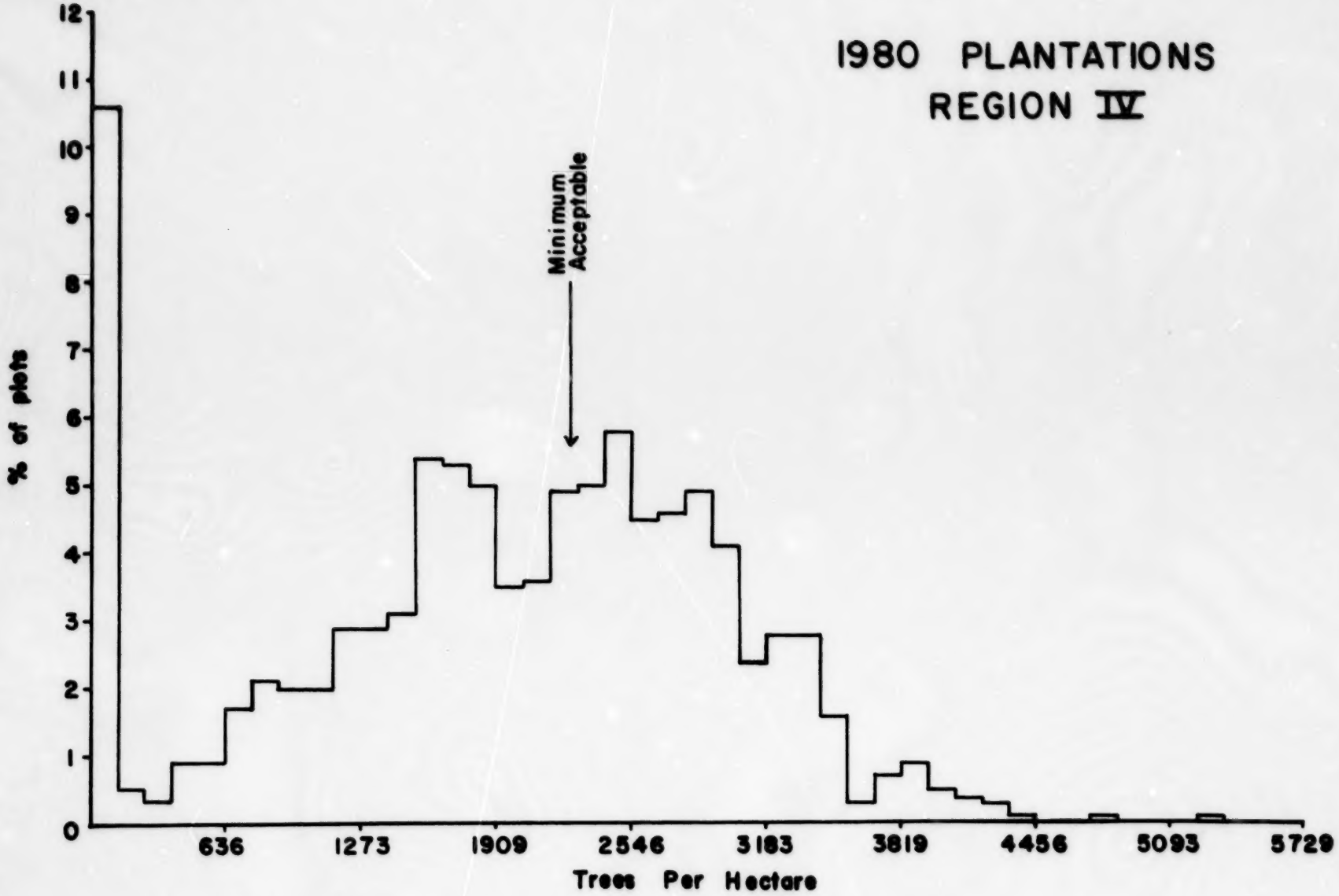


FIGURE IV Percent of plots versus number of planted trees per hectare at time of establishment - Region IV

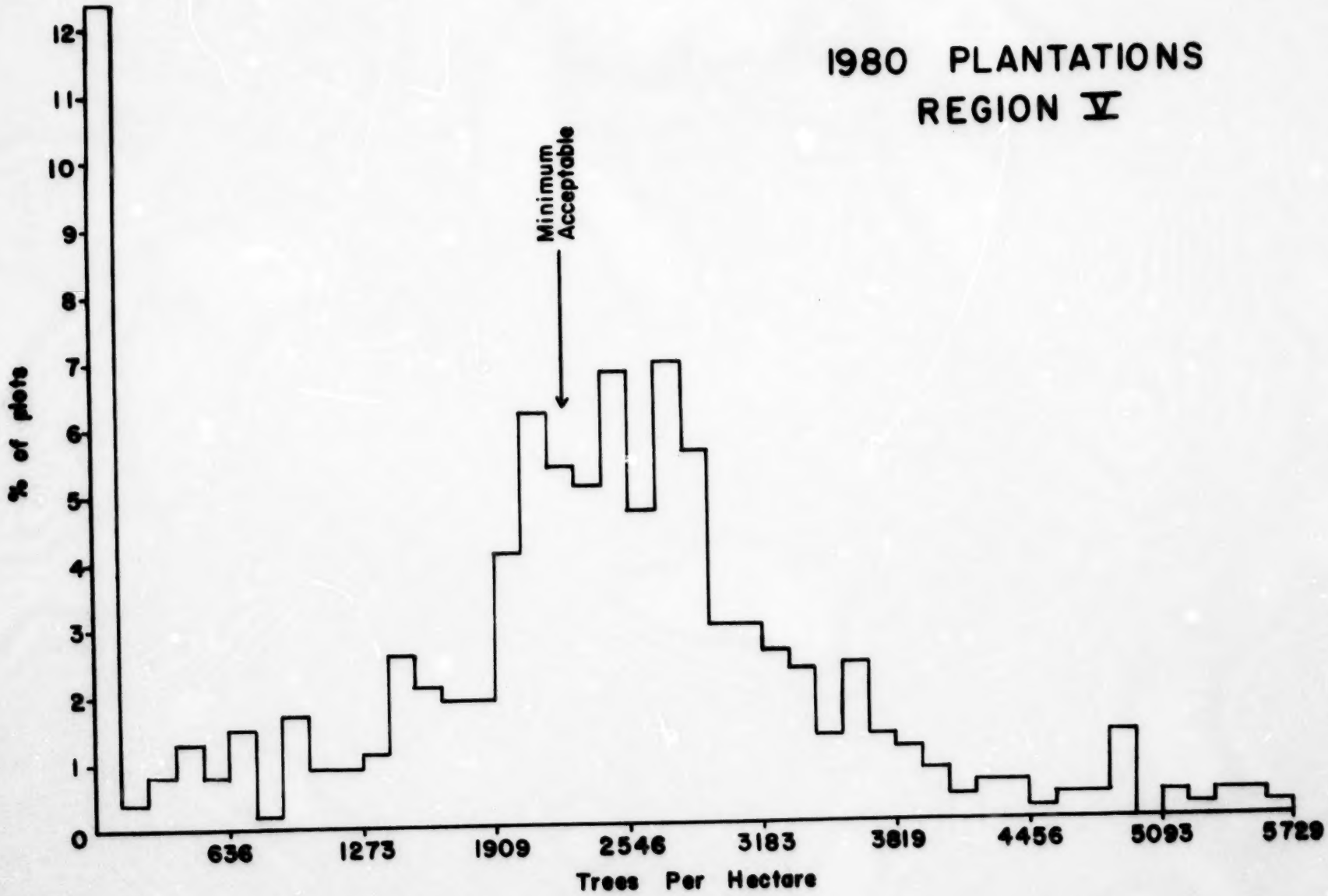


FIGURE V- Percent of plots versus number of planted trees per hectare at time of establishment - Region V

APPENDIX I

FIRST YEAR SURVIVAL, DENSITIES AND HEIGHTS OF 1980 PLANTATIONS

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha)	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
I	P- 1-80	Disc Trencher	108	rP	BR	1,688	27	94	1,589	28
				jP	BR	1,595	18	95	1,501	22
	P- 2-80	Controlled Burn and Finnish Plow	128	tL	PP	1,073	17	100	1,073	23
				jP	BR	2,235	21	92	2,049	27
				jP	PP	1,936	21	100	1,936	29
	P- 3-80	Controlled Burn and Bracke	88	jP	BR	1,926	19	78	1,474	21
			27	bS	BR	1,926	25	76	1,477	27
	P- 4-80	Disc Trencher	70	jP	BR	1,234	19	92	1,135	20
	P- 5-80	Bracke	53	bS	BR	589	26	62	366	24
			9	jP	BR	1,210	23	53	637	21
			-	wS	BR	1,238	28	87	1,006	24
			16	jP	PP	1,337	19	85	1,130	19
	P- 6-80	Finnish Plow and C & H	18	wS	BR	1,963	27	78	1,583	28
				wS	PP	2,674	13	95	2,546	10
				jP	PP	3,056	17	100	3,056	22
	P- 7-80	Disc Trencher	44	bS	BR	1,322	26	76	1,002	26
	P- 8-80	Disc Trencher	34	bS	BR	1,365	26	72	981	26
				bS	PP	552	29	46	255	28
	P- 9-80	Disc Trencher	22	bS	BR	1,801	-	85	1,528	28
	P-10-80	Disc Trencher	19	bS	BR	1,038	29	77	803	27
	P-11-80	Controlled Burn and Bracke	58	bS	BR	1,138	28	58	649	28

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
I	P-19-80	Finnish Plow	81	wS	BR	1,431	25	82	1,170	27
	P-20-80	Finnish Plow	119	bS	BR	1,913	23	90	1,740	27
			-	wS	BR	2,234	24	85	1,886	26
			64	jP	BR	2,618	18	92	2,468	24
	P-21-80	Shark Fin Barrels	32	bS	BR	1,432	26	67	955	27
	P-46-80	Finnish Plow	16	bS	BR	1,797	-	94	1,698	26
	TP- 2-80	Finnish and C & H Plow	48	wS	PP	1,528	26	83	1,273	29
				jP	PP	2,122	20	95	2,016	24
	TP- 3-80	Control Burned and Finnish Plow	37	tL	PP	2,101	15	95	1,997	19
	TP- 4-80	Disc Trencher	85	jP	PP	1,541	20	93	1,426	29
	TP- 5-80	Shark Fin Barrels	174	jP	PP	2,677	17	97	2,592	25
	TP- 6-80	Wildfire and Disc Trencher	87	jP	PP	2,529	17	95	2,450	28
	TP- 7-80	Controlled Burn and Disc Trencher	83	tL	PP	2,504	15	90	2,256	41
	TP- 8-80	Controlled Burn and Disc Trencher	53	wS	PP	2,000	17	90	1,794	23
	TP- 9-80	Controlled Burn and Disc Trencher	64	bS	PP	2,569	15	94	2,427	21
	TP-10-80	Controlled Burn and Disc Trencher	75	bS	PP	2,007	16	91	1,835	23
	TP-11-80	C & H Plow	40	wS	PP	1,729	14	90	1,555	21

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha)	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
I	TP-12-80	Disc Trencher	36	jP	PP	1,592	4	51	804	9
	TP-13-80	Disc Trencher	19	wS	PP	1,926	14	99	1,910	22
			18	jP	PP	1,528	4	17	255	6
	TP-14-80	Disc Trencher	6	jP	PP	713	5	57	407	12
	TP-15-80	Controlled Burn and Disc Trencher	17	jP	PP	2,454	7	92	2,246	14
	TP-16-80	C & H Plow	34	jP	PP	1,079	7	86	933	15
			19	bS	PP	844	18	95	804	23
	TP-17-80	C & H Plow	44	wS	PP	2,331	14	94	2,176	19
	TP-18-80	C & H Plow	18	jP	PP	2,387	-	96	2,292	11
			14	bS	PP	1,974	-	97	1,910	15
	TP-19-80	Controlled Burn and Disc Trencher	32	wS	PP	2,341	18	85	1,998	27
	TP-39-80	Controlled Burn and Shark Fin Barrels	47	bS	PP	2,101	15	88	1,854	22
	TP-40-80	Shark Fin Barrels	95	bS	PP	1,681	-	97	1,636	14
	TP-41-80	Shark Fin Barrels	26	bS	PP	1,671	12	98	1,639	13
	TP-42-80	Shark Fin Barrels	145	bS	PP	1,880	13	96	1,799	15
	TP-43-80	Shark Fin Barrels	148	bS	PP	1,870	12	86	1,610	20
	TP-44-80	Controlled Burn and Shark Fin Barrels	118	bS	PP	2,004	14	94	1,889	26
	TP-45-80	Controlled Burn and Shark Fin Barrels	59	bS	PP	2,574	14	93	2,391	24

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
I	TP-46-80	Shark Fin Barrels	40	Bs	PP	1,728	16	99	1,710	16
	TP-47-80	Shark Fin Barrels	65	bS	PP	1,946	-	87	1,685	15
			80	jP	PP	1,924	-	97	1,865	20
			-	wS	PP	2,292	-	94	2,165	30
	TP-48-80	Controlled Burn	68	jP	PP	2,498	18	91	2,277	26
	FP- 2-80	Controlled Burn	37	jP	BR	528	27	94	495	38
				bS Orig	BR	1,856	57	97	1,807	79
	FP- 3-80	Crusher	26	jP	PP	2,097	28	29	599	38
				jP Orig	PP	1,461	74	89	1,294	89
	FP- 4-80	Finnish Plow	178	bS	PP	1,563	13	86	1,340	20
				bS Orig	BR	1,691	50	99	1,715	66
	FP- 5-80	No Site Preparation	144	bS	BR	1,670	29	79	1,324	32
				bS Orig	PP	2,668	37	97	2,584	73
				jP Orig	PP	2,332	74	94	2,199	111
	NRP*	Shark Fin Barrels		jP	PP	2,865	19	99	2,844	35

*Not reported planted.

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha)	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
II	P-43-80	Finnish Plow	606	jP	BR	2,666	18	93	2,475	25
				bS	BR	2,165	21	100	2,165	24
	P-44-80	Finnish Plow	110	bS	BR	2,373	23	88	2,079	27
				wS	BR	2,389	24	78	1,855	27
	P-45-80	Finnish Plow	159	jP	BR	2,508	19	93	2,324	25
				rP	BR	3,511	23	86	3,009	28
	P-47-80	Disc Trencher	34	jP	BR	1,549	25	83	1,284	28
	P-48-80	Finnish Plow	11	rP	BR	1,921	25	92	1,771	27
				jP	BR	2,575	21	95	2,448	26
	P-49-80	Finnish Plow	124	jP	BR	2,934	19	95	2,798	23
	TP-20-80	Disc Trencher	48	bS	PP	1,830	10	96	1,751	11
				jP	PP	2,024	17	99	2,008	25
	TP-21-80	Crusher	682	bS	PP	2,383	17	91	2,148	23
				jP	PP	2,110	7	92	1,944	15
	TP-79-80	Disc Trencher	257	bS	BR	1,783	12	95	1,698	13
				bS	PP	2,250	11	98	2,214	11
				jP	BR	1,553	26	93	1,451	28
				jP	PP	1,921	12	96	1,841	23
	TP-80-80	Finnish Plow	192	bS	PP	3,121	11	98	3,048	23
	TP-81-80	Finnish Plow	121	bS	PP	2,610	11	99	2,578	19
				wS	PP	2,513	11	97	2,439	20

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
III	P-12-80	No Site Preparation	23	jP	BR	4,329	22	88	3,820	26
	P-13-80	C & H Plow	87	jP	BR	2,278	19	93	2,119	23
	P-14-80	C & H Plow	221	wS	BR	2,433	21	88	2,148	21
				jP	BR	2,294	19	95	2,171	25
				rP	BR	2,412	24	96	2,306	26
	P-15-80	C & H Plow	59	bS	BR	2,255	23	78	1,766	23
	P-16-80	Shark Fin Barrels	459	bS	BR	2,636	24	79	2,075	25
				wS	BR	2,067	21	88	1,820	23
				jP	BR	1,433	17	95	1,363	23
				bS	PP	1,783	14	95	1,687	12
				wS	PP	3,898	11	97	3,765	10
	P-17-80	No Site Preparation	18	bS	BR	1,754	19	83	1,457	16
	P-18-80	C & H Plow	160	bS	BR	2,470	26	76	1,884	25
				jP	BR	2,232	19	92	2,042	22
	TP-24-80	C & H Plow	8	jP	PP	2,117	13	85	1,798	18
	TP-25-80	C & H Plow	136	bS	PP	1,670	8	79	1,311	18
				jP	PP	2,263	14	97	2,188	33
	TP-26-80	C & H Plow	110	bS	PP	2,687	12	84	2,224	21
				wS	PP	1,375	11	94	1,299	21
				jP	PP	2,105	16	95	1,995	23
	TP-27-80	C & H Plow	63	bS	PP	2,052	11	90	1,838	21
				jP	PP	1,662	16	94	1,566	28
	TP-28-80	C & H Plow	81	bS	PP	2,682	10	90	2,415	22

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha)	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
III	TP-29-80	C & H Plow	127	bS	PP	2,411	11	83	1,994	21
	TP-30-80	Shark Fin Barrels	134	bS	PP	2,885	8	96	2,775	9
				bS	BR	3,634	7	97	3,524	10
	TP-31-80	Shark Fin Barrels	53	bS	PP	2,797	10	91	2,535	17
	TP-32-80	Marden Roller	79	bS	PP	2,037	15	88	1,783	19
				bS	SB	1,528	12	81	1,176	19
	TP-33-80	Marden Roller	33	bS	PP	3,756	9	78	2,928	19
	TP-34-80	C & H Plow	64	jP	PP	2,713	16	94	2,605	29
	TP-35-80	Shark Fin Barrels	123	bS	PP	2,678	10	85	2,283	22
	TP-36-80	C & H Plow	413	bS	PP	2,224	9	88	1,962	20
				jP	PP	2,303	5	84	1,928	14
	TP-37-80	C & H Plow	55	bS	PP	2,047	13	84	1,718	21
				bS	SB	2,023	17	90	1,825	25
				jP	PP	2,928	6	55	1,597	11
	TP-38-80	C & H Plow	21	jP	PP	2,340	8	94	2,196	14

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
IV	P-22-80	Finnish Plow	101	wS	BR	2,043	23	78	1,584	23
				bS	PP	2,266	11	71	1,604	11
				wS	PP	1,528	9	69	1,061	10
	P-23-80	Shark Fin Barrels	115	rP	BR	1,282	20	90	1,151	19
	P-24-80	C & H Plow	26	bS	BR	2,318	24	94	2,200	26
			15	bS	PP	3,056	8	96	2,931	15
			-	wS	PP	3,213	11	100	3,213	16
	P-25-80	C & H Plow	99	bS	BR	2,555	24	88	2,260	25
			-	wS	BR	2,585	25	100	2,585	26
			4	jP	BR	2,183	26	94	2,055	25
	TP-49-80	Controlled Burn	135	bS	PP	1,278	12	84	1,068	24
				jP	PP	1,273	14	100	1,273	25
	TP-50-80	Finnish Plow	157	bS	PP	1,566	14	81	1,258	21
				wS	BR	3,438	21	67	2,292	26
	TP-51-80	Controlled Burn	60	bS	PP	2,357	10	92	2,161	30
			-	wS	PP	2,483	9	91	2,266	29
			12	jP	PP	2,542	8	96	2,433	27
	TP-52-80	Shark Fin Barrels	145	bS	PP	1,036	14	93	966	30
				wS	PP	1,432	12	88	1,264	26
	TP-53-80	Shark Fin Barrels	97	bS	PP	1,151	10	86	986	23
				wS	PP	1,592	15	96	1,528	27
	TP-54-80	C & H Plow	51	bS	SB	1,626	13	85	1,372	34
			7	bS	PP	1,576	9	83	1,305	24
	TP-56-80	Shark Fin Barrels	121	bS	PP	2,648	13	92	2,424	23

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha)	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
IV	TP-58-80	C & H Plow	92	bS	PP	2,348	9	89	1,881	20
				jP	PP	2,766	16	98	2,763	33
				jp	BR	2,801	17	92	2,568	39
	TP-59-80	C & H Plow	89	bS	PP	2,410	12	98	2,355	29
	FP- 1-80	Shark Fin Barrels	91	rP	BR	1,879	23	89	1,668	25

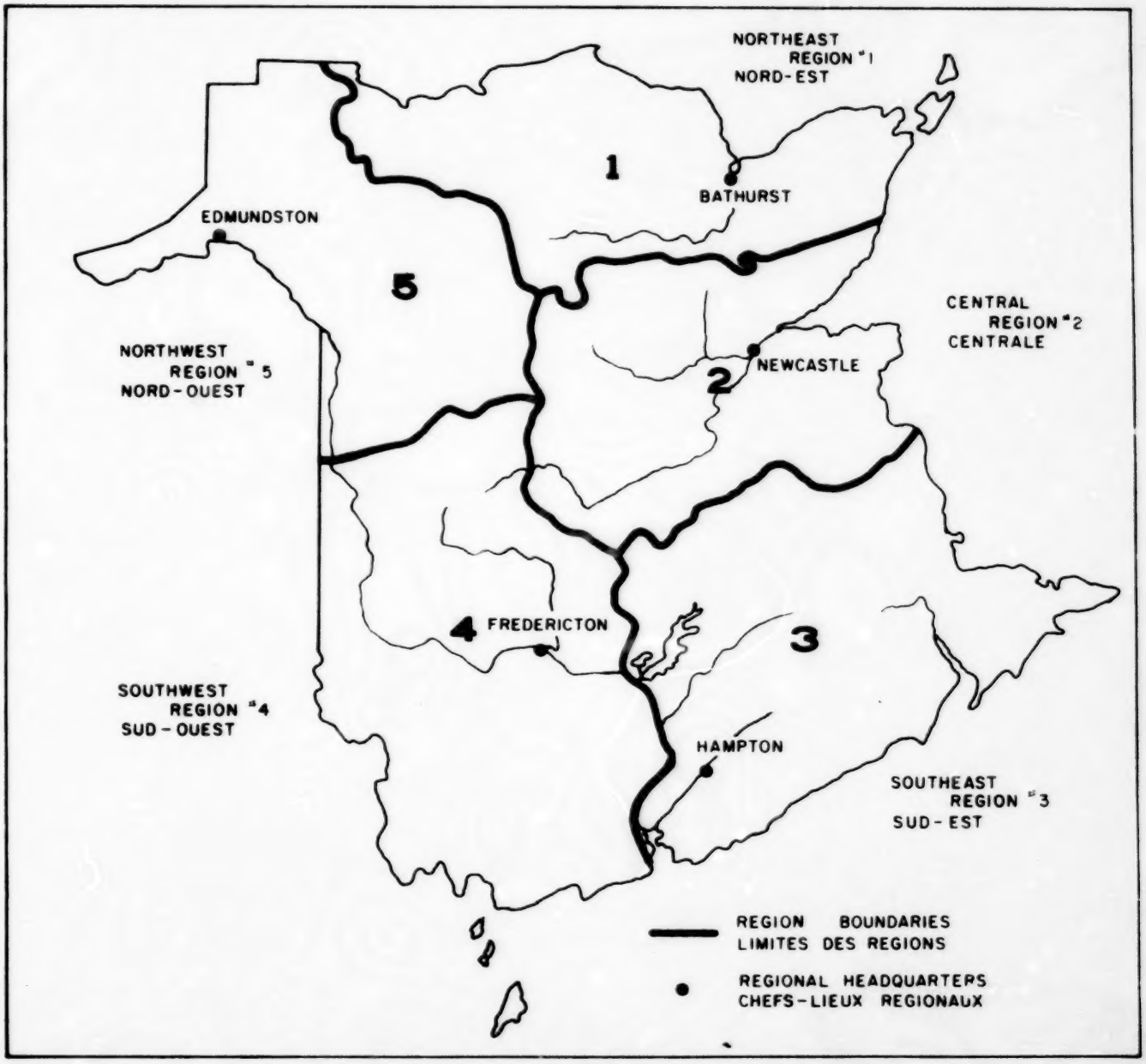
Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
V	P-26-80	Root Rake	5	wS	BR	3,629	16	75	2,737	18
	P-27-80	Root Rake	20	wS	BR	1,790	16	65	1,161	18
	P-28-80	Root Rake	70	wS	BR	1,700	17	83	1,406	19
	P-29-80	Root Rake	12	wS	BR	1,188	19	89	1,061	21
	P-30-80	Root Rake	4	bS	BR	1,528	18	78	1,188	23
	P-31-80	Root Rake	5	bS	BR	2,260	19	73	1,655	22
	P-32-80	Root Rake	9	bS	BR	2,355	24	80	1,889	23
			-	wS	BR	2,165	27	65	1,401	28
	P-34-80	Root Rake	5	bS	BR	1,401	17	55	764	21
	P-35-80	Root Rake	8	bS	BR	2,403	19	67	1,602	25
			13	wS	BR	2,935	19	73	2,151	22
	P-36-80	Root Rake	17	wS	BR	3,327	17	74	2,447	18
	P-37-80	Root Rake	6	bS	BR	255	13	100	255	11
				wS	BR	2,431	19	84	2,037	18
	P-39-80	Root Rake	11	bS	BR	2,903	21	78	2,266	21
	P-40-80	Shark Fin Barrels	2	bS	BR	2,928	23	97	2,844	25
				bS	PP	1,910	19	100	1,910	21
	P-41-80	Root Rake	11	bS	BR	2,201	23	83	1,828	24
	P-42-80	Root Rake	4	bS	BR	2,387	25	85	2,037	23

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Density (trees/ha	Year Height (cm)	Survival (%)	First Year Density (trees/ha)	Height (cm)
V	TP-22-80	Controlled Burn and Disc Trencher	97	bS	PP	1,914	10	80	1,536	20
	TP-55-80	Bracke	8	bS	PP	2,483	16	95	2,355	25
	TP-60-80	Controlled Burn and Bracke	83	bS	PP	2,137	17	94	2,010	23
				wS	PP	2,801	14	92	2,546	26
	TP-61-80	Bracke	24	wS	PP	2,221	13	83	1,853	24
	TP-62-80	Bracke	12	wS	PP	1,464	11	76	1,098	18
	TP-63-80	Bracke	6	wS	PP	2,317	14	95	2,190	25
	TP-64-80	Bracke	11	wS	PP	2,212	12	92	2,037	27
	TP-65-80	Bracke	24	wS	PP	1,855	12	97	1,801	25
	TP-66-80	Bracke	28	bS	PP	1,273	11	82	1,048	16
	TP-67-80	Root Rake	11	bS	PP	1,443	4	71	1,019	9
	TP-68-80	Root Rake	7	wS	PP	2,720	9	97	2,628	26
				wS orig	BR	926	28	100	926	39
	TP-71-80	Root Rake	30	bS	PP	1,744	5	77	1,337	10
	TP-72-80	Root Rake	8	bS	PP	2,012	10	77	1,553	15
	TP-73-80	Controlled Burn and Root Rake	27	bS	PP	2,373	7	69	1,644	13
	TP-74-80	Root Rake	9	bS	PP	968	6	97	942	6
	TP-75-80	Bracke	121	bS	PP	2,110	11	95	2,013	27
	TP-76-80	Bracke	42	bS	PP	1,890	12	96	1,809	29

Region	Plantation	Site Preparation	Area (ha)	Species	Stock Type	Original Year Density (trees/ha)	Original Year Height (cm)	Survival (%)	First Year Density (trees/ha)	First Year Height (cm)
V	TP-77-80	Bracke	32	bS	PP	2,210	13	96	2,119	27
	TP-78-80	Bracke	13	bS	PP	2,126	12	97	2,063	24
	FP- 6-80	Controlled Burn	24	wS	PP	5,842	12	90	5,250	21
				wS Orig	BR	2,919	24	96	2,803	39
	FP- 7-80	Controlled Burn	34	wS Orig	BR	987	23	94	923	30
	FP- 8-80	Controlled Burn	8	wS	PP	3,374	9	87	2,931	20
				wS Orig	BR	3,829	29	100	3,829	35
	FP- 9-80	Root Rake and Anchor Chains	104	bS	PP	2,926	10	83	2,429	17
				bS Orig	PP	2,343	28	96	2,257	34
	FP-11-80	Root Rake	69	bS	PP	4,697	11	81	3,816	18
				wS	PP	1,638	11	87	1,421	20
				bS Orig	BR	3,823	19	82	3,138	26
				wS Orig	BR	2,387	25	65	1,545	32
	FP-12-80	Root Rake	102	bS	PP	3,446	11	90	3,074	18
				ws	PP	4,035	9	89	3,606	15
				bS Orig	BR	3,303	17	31	1,029	23
				ws Orig	BR	3,481	31	51	1,784	41
	FP-13-80	Disc Trencher	19	wS	PP	1,497	13	93	1,396	17
				ws Orig	BR	2,490	26	58	1,434	32
	FP-14-80	Disc Trencher	69	bS	PP	3,581	11	88	3,158	18
				wS	PP	1,958	19	91	1,792	20
				bs Orig	BR	4,163	19	45	1,855	20

APPENDIX II

REGION BOUNDARIES
DEPARTMENT OF NATURAL RESOURCES



LIMITES DES REGIONS
MINISTERE DES RESSOURCES NATURELLES